

Now you'll create your own puzzle piece from toothpicks. Add identical pieces in one direction to make the succeeding figures of your design.

Step 7

Draw Figures 1–3 on your paper. Write recursive routines to generate number sequences for the number of toothpicks, perimeter, and area of each of six figures. Record these numbers in a table. Find the values for a figure made of ten puzzle pieces.

Step 8

Write three questions about your pattern that require recursive sequences to answer. For example: What is the perimeter if the area is 20? Test your questions on your classmates.

In the investigation you wrote number sequences in table columns. Remember that you can also display sequences as a list of numbers like this:

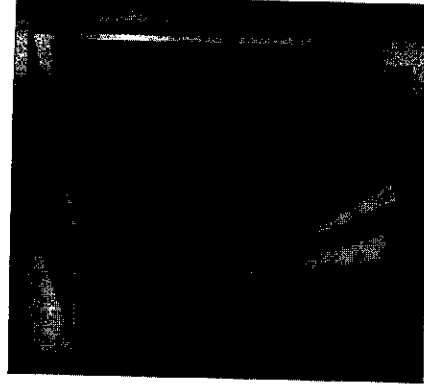
1, 3, 5, 7, ...

Each number in the sequence is called a **term**. The three periods indicate that the numbers continue.

EXAMPLE B

Find the missing values in each sequence.

- 7, 12, 17, , 27, , , 42, , 52
- 5, 1, -3, , -11, -15, , , -27,
- 7, , -29, , -51, -62, , -84,
- 2, -4, 8, -16, 32, , 128, -256, ,



How many hidden numbers can you find?

► Solution

For each sequence, identify the starting value and the operation that must be performed to get the next term.

- The starting value is 7 and you add 5 each time to get the next number. The missing numbers are shown in red.

starting value

\downarrow +5 +5 +5 +5 +5 +5 +5 +5
 7, 12, 17, 22, 27, 32, 37, 42, 47, 52

- The starting value is 5 and you subtract 4 each time to get the next number. The missing numbers are shown in red.

starting value

\downarrow -4 -4 -4 -4 -4 -4 -4 -4
 5, 1, -3, -7, -11, -15, -19, -23, -27, -31

- The starting value is -7. The difference between the fifth and sixth terms shows that you subtract 11 each time.

starting value

\downarrow -11 -11 -11 -11 -11 -11
 -7, -18, -29, -40, -51, -62, -73, -84, -95

- Adding or subtracting numbers does not generate this sequence. Notice that the numbers double each time. Also, they switch between positive and negative signs. So the rule is to multiply by -2. Multiply 32 by -2 to get the first missing value of -64. The last missing values are 512 and -1024.

starting value

\downarrow $\cdot(-2)$ $\cdot(-2)$ $\cdot(-2)$ $\cdot(-2)$ $\cdot(-2)$ $\cdot(-2)$ $\cdot(-2)$ $\cdot(-2)$
 2, -4, 8, -16, 32, -64, 128, -256, 512, -1024

EXERCISES

Practice Your Skills

You will need your graphing calculator for Exercises 2, 5, and 7.

- Evaluate each expression without using your calculator. Then check your result with your calculator.

a. $-2(5 - 9) + 7$

b. $\frac{(-4)(-8)}{-5 + 3}$

c. $5 + \frac{(-6)(-5)}{-7}$

- Consider the sequence of figures made from a row of pentagons.

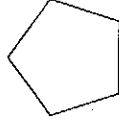


Figure 1

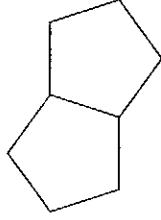


Figure 2

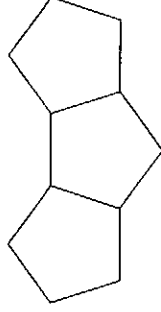


Figure 3

- Copy and complete the table for five figures. **a.**
- Write a recursive routine to find the perimeter of each figure. Assume each side is 1 unit long.
- Find the perimeter of Figure 10. **a.**
- Which figure has a perimeter of 47?

Figure number	Perimeter
1	5
2	8
3	

- Find the first six values generated by the recursive routine

-14.2

ENTER

Ans + 3.7

ENTER, ENTER, ... **a.**

- Write a recursive routine to generate each sequence. Then use your routine to find the 10th term of the sequence.

a. 3, 9, 15, 21, ... **a.**

b. 1.7, 1.2, 0.7, 0.2, ... **a.**

c. -3, 6, -12, 24, ...

d. 384, 192, 96, 48, ...